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Augmented Reality as a Medium for Integrating Local Wisdom and Tolerance in Elementary School Learning: A Systematic Literature Review

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Abstract

The rapid development of digital technology has driven the adoption of innovative learning media in elementary education, including Augmented Reality (AR). Although AR has been widely recognized for enhancing learning engagement and conceptual understanding, its integration with local wisdom and character education particularly tolerance remains limited in the Indonesian elementary school context. This study aims to systematically map research trends on the use of AR in elementary education that integrates local wisdom and tolerance values, as well as to identify existing research gaps that may inform future learning media development, especially those grounded in Panji Malang local wisdom. This study employed a Systematic Literature Review (SLR) following the PRISMA protocol. Through four stages of elimination, 32 empirical research articles published between 2016 and 2025 were selected. Data were analyzed using content analysis and bibliometric mapping with VOSviewer to identify publication trends, research methods, and thematic clusters. The findings indicate a growing interest in AR-based learning since 2022, with most studies focusing on technological development and learning effectiveness. However, the explicit integration of tolerance as an affective learning objective remains limited. Bibliometric analysis reveals three dominant clusters: technology-based learning, local wisdom and cultural values, and elementary school learning contexts. Overall, AR demonstrates strong potential as a medium for integrating local wisdom and tolerance values, though challenges related to teacher readiness, infrastructure, and long-term impact evaluation persist.

INTRODUCTION

The development of digital technology in the last two decades has brought significant changes in the educational landscape, including at the elementary school level. The transformation from traditional learning to technology-based learning requires adjustments to pedagogical strategies so that the learning process remains relevant, effective, and able to respond to the needs of 21st century students (Zou dkk., 2025). One of the technological innovations that continues to show great potential in the development of learning media is Augmented Reality (AR). This technology allows the merging of virtual objects with real environments so as to provide an immersive, contextual and engaging learning experience for elementary school students who are at the stage of concrete operational cognitive development (Rakhimzhanova dkk., 2025). However, the implementation of AR in basic education in Indonesia still faces several challenges and gaps, especially in the context of its integration with local wisdom materials and the cultivation of character values such as tolerance.

In the global context, AR has been widely used to increase learning motivation, abstract concept visualization skills, digital literacy, and culture-based learning (X.-M. Wang dkk., 2023). Some countries use AR to bring cultural artifacts to life, introduce local history, or stimulate narrative-based learning experiences. However, in Indonesia, the application of AR in primary education is still limited and generally focuses on science and mathematics subjects (Alalwan dkk., 2020; Jiang dkk., 2025). In fact, the integration of AR in learning based on local wisdom has great potential not only as a medium for cultural preservation, but also as a means of building students' character through understanding cultural values that are relevant to their social life (Kleftodimos dkk., 2023; Shih dkk., 2020).

One of the local wisdoms that has great potential to be developed through digital media is the story of Panji Malang. The Panji story is an East Java cultural heritage that has been recognized by UNESCO as an Intangible Cultural Heritage since 2017 (UNESCO, 2017). This story contains universal values such as loyalty, wisdom, courage, empathy, and tolerance. However, the interest of the younger generation in Panji's story continues to decline due to the rapid flow of globalization, the dominance of digital popular culture, and the limited learning media that presents Panji's story in an interesting way (Amalia dkk., 2025). Most elementary school students don't even know the figure of Panji and the philosophical values it contains. This condition indicates a serious threat to the sustainability of the local wisdom of Panji, which not only functions as the cultural identity of the people of East Java but also as a source of moral values and character.

In the educational environment, this gap is exacerbated by the lack of integration of Panji materials in the school curriculum, both in Indonesian, Cultural Arts, and PPKn subjects. Teachers often experience obstacles in introducing Panji stories due to the limitations of teaching materials that are interesting, relevant, and easy to understand for elementary school students (Riley dkk., 2024; Sari & Wahyudi, 2023). Learning that relies on long text without interactive visual support is not able to compete with more dynamic digital content such as games, animations, or videos (Mason dkk., 2022). As a result, Panji's stories tend to be considered old-fashioned, uninteresting, and irrelevant by students. This perception widens the distance between the younger generation and the local cultural heritage that should be part of the formation of their identity and character.

In the context of instilling character values, especially tolerance, Panji's story has extraordinary narrative power. The value of tolerance is reflected in scenes that show respect for differences, peaceful resolution of conflicts, and an open attitude to diverse social experiences. However, the use of Panji's story as a medium for instilling the value of tolerance is still very limited. Character education in elementary schools generally emphasizes the values of discipline, responsibility, and honesty, so that the aspect of tolerance as a cultural value is often overlooked (Aningsih dkk., 2022). In fact, in the context of a multicultural Indonesian society, the value of tolerance is a key element in realizing social harmony and strengthening the profile of Pancasila students (Lestari & Sa’adah, 2021).

The use of AR has the potential to bridge this gap. AR can provide a learning experience that makes Panji's story feel alive and relevant to students. The three-dimensional visualization of the characters and scenes in Panji's story allows students to understand the values contained in it through contextual and immersive visual representations (Kontogiorgakis dkk., 2024). This experience not only enhances the appeal of learning but also strengthens the process of

internalizing the value of tolerance (Pellas dkk., 2019). Thus, AR has a strategic function as a medium for preserving local culture as well as a means of strengthening character.

However, there are several other gaps that are the basis for the urgency of this research based on interviews conducted in schools. First, AR learning media that integrates Indonesian local wisdom is still very limited. Most of the educational AR applications in circulation focus on cognitive concepts and lack touch on affective aspects such as character and values. Second, teachers as digital learning implementers often do not have access to AR media that is relevant to local culture. Limited training and resources cause teachers to not be optimal in utilizing digital technology as a means of cultural strengthening. Third, research on AR for instilling the value of tolerance through local wisdom such as Panji's story is still minimal, so this research gap needs to receive more serious attention.

Referring to these various gaps, the development of Panji Malang's story-based AR learning media is an urgent need. This media is believed to be able to make a significant contribution not only in the preservation of local culture but also in the formation of students' character, especially the value of tolerance, which is urgently needed in ethnically, culturally, and socially diverse societies. The integration between digital technology, local wisdom, and character education is a relevant and innovative approach in realizing the goals of national education.

The urgency of this research is underscored by multiple converging factors. First, the accelerating pace of globalization and digital transformation threatens to erode local cultural identities, making systematic efforts to preserve and transmit local wisdom through engaging digital media an educational imperative. Second, rising concerns about social cohesion in Indonesia's diverse society highlight the critical importance of effective tolerance education beginning in elementary school, when foundational attitudes and values are formed. Third, the UNESCO recognition of Panji stories as Intangible Cultural Heritage carries an implicit obligation for cultural preservation and transmission to younger generations, yet current educational practices fall far short of meeting this responsibility. Fourth, teachers as digital learning implementers frequently lack access to AR media relevant to local culture, and limited training and resources prevent optimal utilization of digital technology for cultural strengthening. Fifth, the post-pandemic educational landscape has accelerated digital technology adoption, creating unprecedented opportunities for innovative approaches that were previously constrained by infrastructure limitations.

In line with that, this study also adds one important goal, namely, to conduct a comprehensive mapping of research developments related to AR, local wisdom, tolerance values, and digital learning through the Systematic Literature Review (SLR) approach. Through SLR, this study seeks to identify trends, patterns, strengths, and weaknesses of previous research so that it can produce a solid theoretical and empirical foundation in the development of Panji Malang-based AR learning media. Thus, this research is expected to be able to make a holistic contribution to both the theoretical and practical realms, while strengthening the role of digital technology in preserving local culture and instilling the value of tolerance in elementary schools.

METHOD

This study used *the Systematic Literature Review* (SLR) approach which is compiled based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses protocol (Haddaway dkk., 2022). This approach was chosen to gain a comprehensive understanding of research trends related to augmented reality (AR), local wisdom, cultural tolerance values, and digital learning in the context of basic education in Indonesia. The SLR process is carried out through four elimination stages that are systematically designed to ensure that the articles analyzed have strong academic and methodological relevance.

The first stage is carried out by selecting the type of scientific work so that only original *research articles* are used, while other types of publications such as *review articles*, books, proceedings, and work reports are eliminated. This step is taken to ensure that the data used is empirical and methodologically accountable. The second stage of elimination is done through the filtering of titles, abstracts, and keywords, focusing on the relevance of the content. At this stage, articles that do not discuss AR, do not mention elements of local wisdom, do not contain the value of cultural tolerance, or are not in the Indonesian context are eliminated. This selection aims to ensure that the articles defended are directly related to the research focus, namely the integration of digital technology, local culture, and character learning. The third stage is carried out by identifying and eliminating articles that use a similar method, namely research that is also in the form of SLR or meta-analysis. The article was excluded because the study required primary empirical evidence, not secondary synthesis that could lead to duplication of findings.

The final stage is an in-depth screening by reading the entire content of the article to assess the suitability of the theme, context, and subject of the research. At this stage, the article is eliminated if the discussion does not lead to the value of tolerance as a cultural value, does not focus on the implementation of cultural values in learning, or the research subject is not at the elementary school level. Articles that only mention culture or technology without connecting it to the context of character education are also eliminated. The articles that passed were then analyzed using *content analysis techniques* to identify patterns, themes, and research trends related to AR integration, preservation of local wisdom, instilling tolerance values, and the development of digital learning in elementary schools. The results of this analysis produced a map of findings that included research trends, *research gaps*, and directions for the development of relevant learning media, especially in the context of strengthening the value of tolerance through the story of Panji Malang based on AR.

RESULTS AND DISCUSSION

The results in this study will be presented in several presentations as well as highlight important findings and identify key issues. The presentation of the findings of this research will be divided into the grouping of research clusters and distribution, year of publication, academic discipline, country of origin of contributing authors, and the influence between materials on research trends presented in the visualization map.

Publication of Articles by Year

The search strategy for scientific articles to be reviewed is to focus on publications in the last decade. The content focused on the use of augmented reality technology in the field of

education to teach local wisdom and tolerance. The distribution of the year of publication will be shown in the following chart.

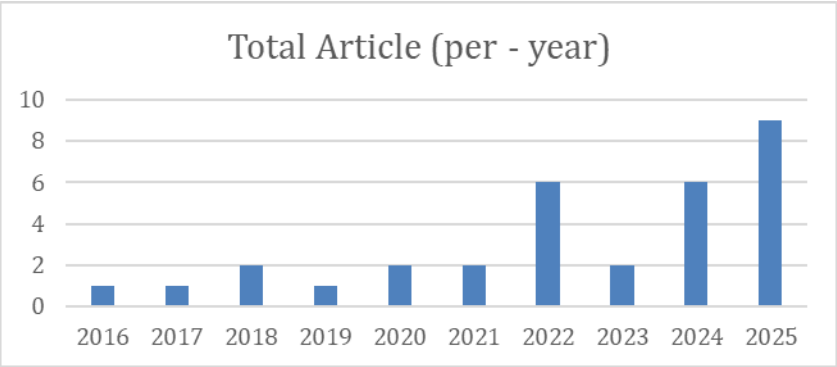

Figure 1. Chart of Total Article/Year

Based on the chart above, it is shown that the research carried out tends to fluctuate, but in the range of 2016 – 2021 the interest shown is not too significant. Then there is a fairly rapid development in 2022 – 2025. As shown in the diagram above, the most publications were in 2025 which showed that there were 9 articles, followed by 2024 and 2022 with a total of 6 articles. This trend shows an increase in research focus and interest in learning technologies that integrate AR and local wisdom as taught content.

Methodology Analysis of The Reviewed Articles

The research methods used in the articles to be reviewed are quite diverse in their implementation. Of the many articles that are reviewed, the method that is often used is the qualitative method of 50% of the total articles by conducting interviews with users related to the use of augmented reality technology in learning activities. While quantitative research shows 21%, the method used is on average an experimental study that compares conditions before and after treatment. Mixed method research amounted to 29% that combined quantitative interviews and quantitative calculations to support a more comprehensive understanding related to the use of augmented reality in local wisdom and tolerance. If visualized in the form of a diagram it will look like in the following image.

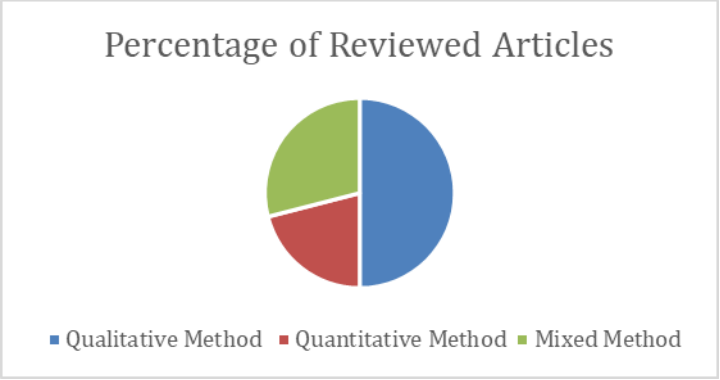

Figure 2. Percentage of Method in Reviewed Articles

Research Country Affiliation

Based on the results of analysis from researcher affiliates in a number of articles, it was found that many studies that discuss the use of AR, especially in the field of education, were developed in European areas, such as the United Kingdom, Spain, Greece, Germany, Scotland, Wales and Portugal, while in Asia only a few authors have an interest in augmented reality research. While the other result is that because it is more oriented to local wisdom in the context in Indonesia and the learning of Pancasila Education in the material, the majority of the authors come from Indonesia. The following are pictures and tables showing details of the country of origin of the author of each article reviewed.

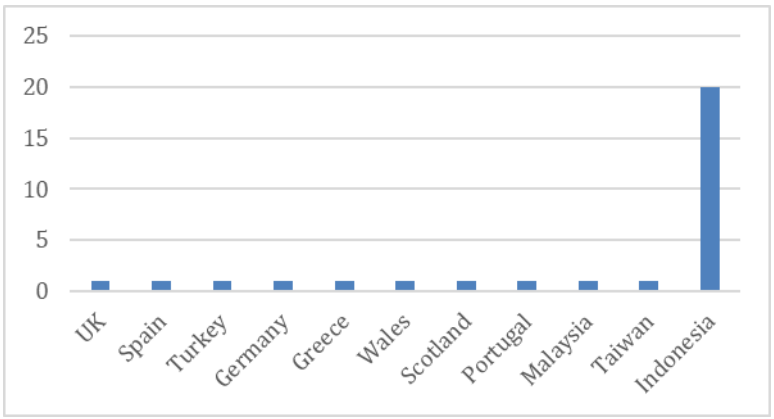

Figure 3. Research Country Affiliation

Table 1. Article Data Analysis Table

S/N	Author's Name & Year	Methodology	Country	Journal	Quartile
1	(Martín-Gutiérrez dkk., 2017)	Qualitative Method	Spain	EURASIA: Journal of Mathematics Science and Technology Education	Q2
2	(Akçayır dkk., 2016)	Quantitative Method	Turkey	Computers in Human Behavior	Q1
3	(Tom Dieck & Jung, 2018)	Qualitative Method	UK	Current Issues in Tourism	Q1
4	(Rauschnabel dkk., 2022)	Qualitative Method	Germany	Computers in Human Behavior	Q1
5	(Mystakidis, 2022)	Qualitative Method	Greece	Encyclopedia	N/A
6	(Masood & Egger, 2019)	Qualitative Method	Scotland	Robotics and Computer Integrated Manufacturing	Q1
7	(Dwivedi dkk., 2022)	Mixed Method	Wales	International Journal of Information Management	Q1
8	(Che Dalim dkk., 2020)	Qualitative Method	Malaysia	International Journal of Human-Computer Studies	Q1
9	(Allcoat dkk., 2021)	Quantitative Method	UK	Journal of Educational Computing Research	Q1
10	(Mota dkk., 2018)	Quantitative Method	Spain	Computers and Electrical Engineering	Q1
11	(Casteleiro-Pitrez, 2021)	Qualitative Method	Portugal	Revista Iberoamericana De Tecnologias Del Aprendizaje	Q2

S/N	Author's Name & Year	Methodology	Country	Journal	Quartile
12	(Huang dkk., 2023)	Quantitative Method	Taiwan	Systems	N/A
13	(Tohri dkk., 2022)	Quantitative Method	Indonesia	International Journal of Evaluation and Research in Education	Q3
14	(Dharma dkk., 2025)	Qualitative Method	Indonesia	Journal of Education and E Learning Research	Q3
15	(Mahartini dkk., 2024)	Mixed Method	Indonesia	Edelweiss Applied Science and Technology	Q3
16	(Hasan dkk., 2024)	Quantitative Method	Indonesia	Education 3 13	Q2
17	(Hasan dkk., 2025)	Qualitative Method	Indonesia	Research in Dance Education	Q1
18	(Pratiwi dkk., 2022)	Qualitative Method	Indonesia	Journal of Social Studies Education Research	Q2
19	(Patras dkk., 2025)	Qualitative Method	Indonesia	Educational Process International Journal	Q2
20	(Sijabat dkk., 2025)	Mixed Method	Indonesia	Aptisi Transactions on Technopreneurship	Q3
21	(Isnaniah dkk., 2025)	Mixed Method	Indonesia	Salud Ciencia Y Tecnologia	N/A
22	(Septinaningrum dkk., 2022)	Quantitative Method	Indonesia	Ingenierie Des Systemes D Information	Q3
23	(Afifuddin dkk., 2025)	Mixed Method	Indonesia	Frontiers in Education	Q1
24	(Erkanlı dkk., 2024)	Mixed Method	Indonesia	Frontiers in Education	Q1
25	(Muhammad & Liu, 2025)	Mixed Method	Indonesia	Education 3 13	Q2
26	(Azkiya dkk., 2025)	Qualitative Method	Indonesia	Munaddhomah	Q2
27	(Andriani dkk., 2023)	Mixed Method	Indonesia	Revista De Gestao Social E Ambiental	N/A
28	(Rachmadtullah dkk., 2020)	Qualitative Method	Indonesia	Universal Journal of Educational Research	N/A
29	(Bahtiar dkk., 2024)	Qualitative Method	Indonesia	Edelweiss Applied Science and Technology	Q3
30	(Subandi dkk., 2025)	Qualitative Method	Indonesia	Perspectives in Education	Q3
31	(Nurhayati dkk., 2025)	Qualitative Method	Indonesia	Asian Association of Open Universities Journal	Q2
32	(Rochmiyati dkk., 2024)	Qualitative Method	Indonesia	Theory and Practice in Language Studies	Q1

Journal Distribution

Based on data analysis, publications that discuss Augmented Reality (AR) as well as local wisdom and tolerance are most widely published in journals in the field of education and educational technology, which places AR as an innovative learning medium for integrating local wisdom values and strengthening tolerance attitudes. In addition, a number of articles were also accommodated by information technology and information systems journals that

emphasized aspects of design, user interaction, and the effectiveness of technology with cultural context as supporting content. Meanwhile, the contribution of social, cultural, and language science journals is relatively more limited and focuses on AR as a means of cultural representation and the preservation of local values. Overall, the distribution of publishers shows the character of an interdisciplinary study with a strong dominance in educational disciplines.

Cluster Analysis

After the process of refining the data from Scopus, the data is imported into VOSviewer to analyze and group areas of study related to the use of augmented reality technology in learning that is integrated with local wisdom and tolerance values. VOSviewer is used for its ability to present easy-to-understand graphical visualizations, especially in displaying key terms and their relevance in a research area. Through cluster mapping, a visual representation of thematic areas is obtained that allows the regrouping of interrelated topics into broader categories based on the co-emergence of keywords and their level of relevance.

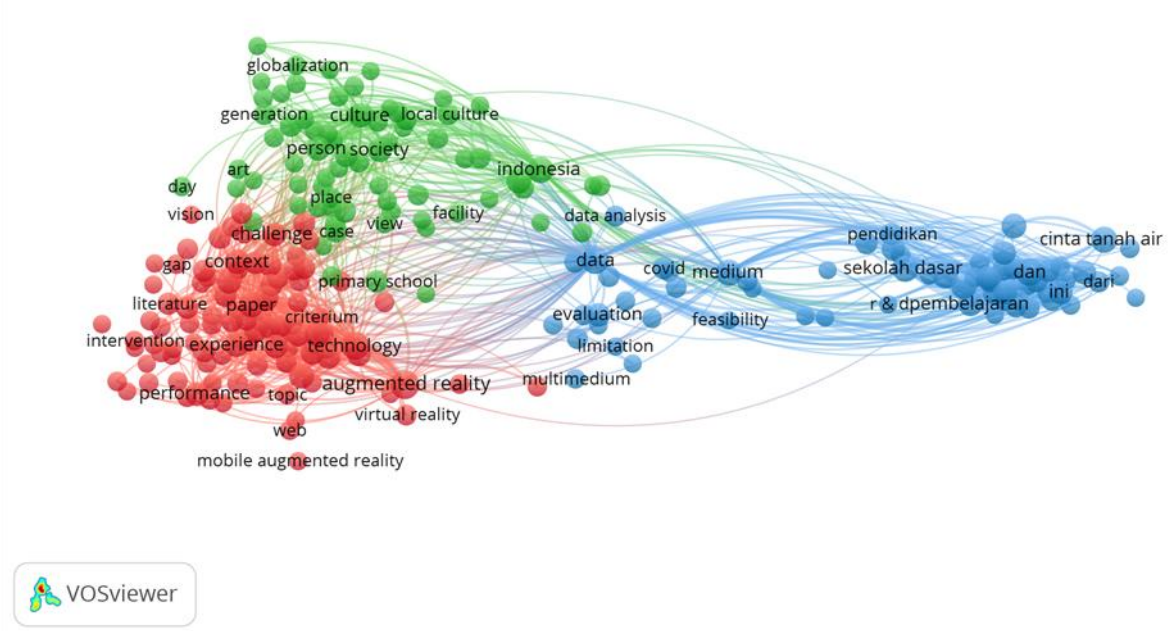

Figure 4. Cluster Analysis Generated from VOSViewer

Bibliometric mapping using VOSviewer in a study that examines Augmented Reality (AR), local wisdom, and tolerance in elementary school learning shows interconnected thematic structures and forms an interdisciplinary study ecosystem. The keyword network visualization shows several key clusters that represent the research focus, methodological approach, and value orientation that are developing in the literature. These clusters do not stand alone, but rather intersect, thus providing a comprehensive picture of how technology, culture, and character education are integrated in the context of learning in elementary schools.

Cluster 1 (Use of Technology in Learning)

Clusters related to the use of AR and digital media in elementary school learning are characterized by the emergence of keywords such as augmented reality, virtual reality, mobile augmented reality, technology, smartphones, media, modules, evaluation, feasibility, and performance. The existence of this keyword shows that research focuses a lot on the

development and use of digital technology-based learning media to improve the quality of the teaching and learning process in elementary schools. AR is positioned as a pedagogical innovation that is able to present learning materials visually, interactively, and contextually, so that it is more in line with the characteristics of elementary school-age students who tend to learn through concrete experiences.

In addition, the relationship between AR and terms such as *experience* and *effect* indicates that aspects of learning experience and the impact of media use are the main concerns of researchers. The research not only assesses the success of AR from a technical standpoint, but also from its effectiveness in improving concept understanding, learning motivation, and student engagement. The use of mobile devices, such as smartphones and tablets, strengthens learning flexibility and allows for wider application of AR in primary school settings. Thus, this cluster represents a research direction that places AR as an innovative learning solution based on digital technology that is relevant to the demands of 21st century education.

Cluster 2 : Local Wisdom and Tolerance

Another cluster that stands out in the VOSviewer mapping is the cluster related to local wisdom, which is characterized by keywords such as *local culture*, *culture*, *art*, *society*, *diversity*, *Indonesia*, and *globalization*. This cluster shows that local wisdom is an important theme in the study of elementary learning, especially in the context of a multicultural country such as Indonesia. Local wisdom is seen as a source of values, knowledge, and cultural identity that needs to be inherited from an early age through formal education. The relationship between local wisdom and the term *globalization* reflects academic awareness of the challenges of globalization that have the potential to erode local cultural identity. Therefore, learning based on local wisdom in elementary schools not only aims to introduce regional culture, but also build students' awareness of the noble values that live in society. Local art, traditions, languages, and social practices become relevant learning content to foster a sense of belonging, cultural pride, and contextual understanding of students' social environment.

In this mapping, the connection of local wisdom with the educational context shows that local wisdom is not positioned as an additional material alone, but as an integral part of the curriculum and learning strategies. This emphasizes the role of elementary schools as the main foundation in the formation of cultural identity and character of students, as well as a space to transmit social values sourced from local culture. The aspect of tolerance in elementary school learning is implicitly illustrated through keywords such as diversity, society, context, and challenge that are connected to cultural and educational clusters. Although the term tolerance does not always appear explicitly, the link between cultural diversity and social context suggests that tolerance is a core value in this study. The studies that are part of this cluster emphasize the importance of education that is able to respond to diverse social realities, both in terms of culture, religion, language, and social background.

Elementary school is seen as a strategic stage to instill an attitude of tolerance because at this age students begin to build a mindset, attitude, and social values. Learning that raises the context of local cultural diversity indirectly encourages students to understand differences, appreciate diversity, and develop social empathy. Thus, tolerance is not taught as an abstract concept, but rather internalized through contextual and meaningful learning experiences. The relationship between tolerance and the challenge keyword indicates that the cultivation of tolerance values in elementary schools still faces various challenges, such as differences in

student backgrounds, limited learning media, and teacher readiness. Therefore, an innovative approach is needed that is able to bridge social values with learning practices that are interesting and relevant to students.

Cluster 3: Learning in Primary Schools

The integration between AR, local wisdom, and tolerance is evident from the interconnectedness between clusters in the VOSviewer mapping. Technology clusters containing AR and digital media are closely connected to cultural and social clusters, which shows that technology plays an integrative medium in conveying local wisdom content and tolerance values. AR allows for visual and interactive representations of local cultures, so that learners can experience more concrete and contextual learning. Through AR, cultural elements such as traditional houses, traditional dances, folklore, and social practices can be presented in an engaging digital form, without losing the meaning and value contained in them. This kind of learning experience not only enhances students' cognitive understanding, but also fosters an appreciative attitude towards one's own culture and other cultures. Thus, AR serves as an effective pedagogical tool to integrate cultural education and tolerance in elementary learning.

The implications of the integration of the three on learning in elementary schools are very significant. Learning is no longer solely oriented to knowledge transfer, but also to character building, strengthening cultural identity, and developing tolerant attitudes. AR-based learning models that elevate local wisdom have the potential to create a holistic learning experience, where the cognitive, affective, and social aspects of students develop in a balanced manner. This is in line with the goals of basic education which emphasizes the formation of character and readiness of students to live in a pluralistic society. Overall, the VOSviewer mapping shows that the study of AR, local wisdom, and tolerance in elementary learning forms a thematic unit that reinforces each other. The integration of technology with cultural and social values is not only academically relevant, but also strategic in responding to educational challenges in the digital and global era. Primary school learning that integrates these three aspects has the potential to produce a young generation that is tech-literate, rooted in local culture, and has a tolerant attitude in life community.

Discussion

Augmented Reality Studies in Elementary School Learning

The results of bibliometric mapping using VOSviewer show that the study of Augmented Reality (AR) in elementary school learning is dominated by research that focuses on the development, evaluation, and effectiveness of learning media. The emergence of keywords such as *augmented reality*, *mobile augmented reality*, *media*, *evaluation*, and *performance* confirms that AR is seen as a pedagogical solution to improve the quality of learning. In the context of elementary school, AR offers advantages in the form of concrete visualizations, direct interactions, and immersive learning experiences, so that it is in accordance with the characteristics of early childhood learners who need experiential learning (Criollo-C dkk., 2024; AlAli & Al-Barakat, 2024). However, the dominance of this technical approach also shows that AR studies are still heavily oriented towards the functional aspects of technology, while the pedagogical dimension and social value are not yet fully the main focus (Koumpouros, 2024; M. Wang dkk., 2018).

Local Wisdom as Value-Based Learning Content

Clusters related to local wisdom display keywords such as *local culture*, *art*, *society*, *diversity*, and *Indonesia*, which reflect a strong focus on local wisdom in elementary school learning. These findings confirm that local wisdom is seen as a source of relevant cultural values and identities to be instilled from an early age(Ebele, 2024; Sakti dkk., 2024). Learning based on local wisdom allows students to understand their social and cultural environment more deeply, while building a sense of belonging to their own culture (Nurhadianto, 2024). However, this discussion shows that the integration of local wisdom is often still contextual and thematic, not fully structured in technology-based learning designs such as AR (Fitrianto & Farisi, 2025). Therefore, a more systematic pedagogical approach is needed so that local wisdom is not only content, but also the basis of values in learning.

Tolerance as an Affective Goal of Elementary Learning

The tolerance aspect in the VOSviewer mapping is reflected through the interconnectedness of the keywords *diversity*, *society*, *context*, and *challenge*, which shows that tolerance is positioned as a social value inherent in diversity-based learning. In the context of elementary school, tolerance is a very important affective goal because at this stage students begin to form social attitudes and values (Rambe dkk., 2022; Situmeang dkk., 2023). Learning that promotes cultural and social diversity contextually has the potential to foster mutual respect and empathy. Nevertheless, this discussion reveals that tolerance is often treated as an indirect impact of learning, rather than as an explicitly designed goal in the use of AR and digital media.

Integration of AR, Local Wisdom, and Tolerance in Learning Practices

The interconnectedness between clusters in the VOSviewer mapping shows the integration between AR, local wisdom, and tolerance in elementary school learning. AR acts as a medium that bridges the delivery of local wisdom content with an interesting and interactive learning approach (Yulia & Suttrisno, 2024). Through AR-based visualizations and simulations, students can explore local culture and social diversity in a more concrete way, thereby encouraging understanding and appreciation of differences (Lim & Lee, 2025). This integration confirms that technology not only serves as an auxiliary tool, but also as a means of internalizing cultural values and tolerance in learning (Prayogi dkk., 2019).

Implementation Challenges and Research Gaps

Although it shows great potential, the mapping results also reveal a number of challenges. First, the limited infrastructure and readiness of teachers in implementing AR in elementary schools are still the main obstacles. Second, most research still focuses on specific local contexts, so generalizing findings to broader contexts requires caution. Third, studies on the long-term impact of AR use on the formation of tolerant attitudes and students' character are still relatively limited. This gap points to the need for more in-depth and ongoing follow-up research (Familoni & Onyebuchi, 2024; Saavedra dkk., 2025).

Theoretical and Practical Implications for Primary Education

Theoretically, these findings reinforce the view that technology-based learning needs to be combined with cultural contexts and social values in order to have a broader meaning. The integration of AR, local wisdom, and tolerance contributes to the development of a holistic learning model that includes cognitive, affective, and social aspects. Practically, these results imply the need to develop a curriculum and teacher training that supports the use of AR based

on local wisdom. Thus, elementary school learning can be a strategic vehicle to form a generation that is technologically literate, rooted in local culture, and has a tolerant attitude in community life.

CONCLUSION

This study concludes that studies on the use of Augmented Reality (AR) in elementary school learning show a significant increasing trend in the last decade, especially from 2022 to 2025. Through the PRISMA protocol-based Systematic Literature Review (SLR) approach to 32 selected articles, it was found that AR is positioned as an innovative learning medium that is effective in improving students' learning experience through concrete visualization, immersive interaction, and active engagement. Nevertheless, most research still focuses on technological and cognitive aspects, while the affective dimensions and social values have not been fully developed systematically. The results of bibliometric mapping and cluster analysis revealed that the integration between AR, local wisdom, and tolerance values formed an interdisciplinary study ecosystem. Local wisdom is seen as a source of cultural values and relevant identities to be instilled from basic education, especially in the context of multicultural Indonesian society. The value of tolerance, although often appearing implicitly through themes of diversity and social context, has not been widely conceived as an explicit affective learning goal in the development of AR media. These findings show that there is a gap between the pedagogical potential of AR and its implementation practice in character education. Conceptually, the integration of AR with local wisdom has strategic power to bridge the challenges of globalization and cultural preservation. AR allows for both visual and contextual representation of local cultures, thus not only strengthening students' cognitive understanding, but also supporting the process of internalizing social values such as tolerance, empathy, and appreciation for differences. In this context, Panji Malang's story has great potential as value-based learning content that can be innovatively packaged through AR technology to answer the learning needs of the 21st century. However, this study also identified a number of key challenges, including the limitations of technological infrastructure, teacher readiness, and the lack of empirical studies examining the long-term impact of AR use on the formation of tolerance attitudes of elementary school students. In addition, the dominance of qualitative research shows the need to strengthen quantitative and experimental studies that specifically measure changes in students' attitudes and characteristics.

REFERENCES

Afifuddin, A., Amri, M., Latif, A., Rosmini, R., & Bin Tahir, S. Z. (2025). Negotiating multicultural values within centralized education systems: A case study of Indonesia. *Frontiers in Education, 10*, 1620685. https://doi.org/10.3389/feduc.2025.1620685

Akçayır, M., Akçayır, G., Pektaş, H. M., & Ocak, M. A. (2016). Augmented reality in science laboratories: The effects of augmented reality on university students' laboratory skills and attitudes toward science laboratories. *Computers in Human Behavior*. https://www.sciencedirect.com/science/article/pii/S0747563215303253

Alalwan, N., Cheng, L., Al-Samarraie, H., Yousef, R., Ibrahim Alzahrani, A., & Sarsam, S. M. (2020). Challenges and Prospects of Virtual Reality and Augmented Reality Utilization among Primary School Teachers: A Developing Country Perspective. *Studies in Educational Evaluation, 66*, 100876. https://doi.org/10.1016/j.stueduc.2020.100876

Allcoat, D., Hatchard, T., Azmat, F., Stansfield, K., Watson, D., & Von Mühlenen, A. (2021). Education in the Digital Age: Learning Experience in Virtual and Mixed Realities. *Journal of Educational Computing Research*, *59*(5), 795–816. https://doi.org/10.1177/0735633120985120

Amalia, R., Shifa, L. N., & Fadilah, A. A. (2025). Pengaruh Globalisasi terhadap Minat Generasi Muda dalam Melestarikan Kesenian Tradisional Indonesia. *TSAQOFAH*, *5*(1), 675–684. https://doi.org/10.58578/tsaqofah.v5i1.4577

Andriani, N., Ulfatin, N., Imron, A., & Sumarsono, R. B. (2023). Heutagogy and Indigenous Knowledge in Integrated Thematic Instruction and Character Education. *Revista de Gestão Social e Ambiental*, *17*(7), e03692. https://doi.org/10.24857/rgsa.v17n7-030

Aningsih, ., Zulela, M., Neolaka, A., Iasha, V., & Setiawan, B. (2022). How is the Education Character Implemented? The Case Study in Indonesian Elementary School. *Journal of Educational and Social Research*, *12*(1), 371. https://doi.org/10.36941/jesr-2022-0029

Azkiya, H., Ws, H., & Hayati, Y. (2025). E-Module Based on Multicultural Values: Development Strategy for Islamic Primary Education. *Munaddhomah: Jurnal Manajemen Pendidikan Islam*, *5*(4), 421–434. https://doi.org/10.31538/munaddhomah.v5i4.1511

Bahtiar, R. S., Wuryandani, W., Sujarwo, S., Wibowo, A. H., & Suryarini, D. Y. (2024). The implementation of multicultural education in Indonesian elementary education system. *Edelweiss Applied Science and Technology*, *8*(6), 7178–7187. https://doi.org/10.55214/25768484.v8i6.3548

Casteleiro-Pitrez, J. (2021). Augmented Reality Textbook: A Classroom Quasi-Experimental Study. *IEEE Revista Iberoamericana de Tecnologias del Aprendizaje*, *16*(3), 258–266. https://doi.org/10.1109/RITA.2021.3122887

Che Dalim, C. S., Sunar, M. S., Dey, A., & Billinghurst, M. (2020). Using augmented reality with speech input for non-native children's language learning. *International Journal of Human-Computer Studies*, *134*, 44–64. https://doi.org/10.1016/j.ijhcs.2019.10.002

Criollo-C, S., Guerrero-Arias, A., Guaña-Moya, J., Samala, A., & Luján-Mora, S. (2024). Towards Sustainable Education with the Use of Mobile Augmented Reality in Early Childhood and Primary Education: A Systematic Mapping. *Sustainability*, *16*(3), 1192. https://doi.org/10.3390/su16031192

Dharma, I. M. A., Dantes, N., Lasmawan, I. W., & Suastika, I. N. (2025). Effectiveness of digital storybooks based on Balinese culture for enhancing cultural-civic literacy and Pancasila education outcomes. *Journal of Education and E-Learning Research*, *12*(2), 165–178. https://doi.org/10.20448/jeelr.v12i2.6749

Dwivedi, Y. K., Hughes, L., Baabdullah, A. M., Ribeiro-Navarrete, S., Giannakis, M., Al-Debei, M. M., Dennehy, D., Metri, B., Buhalis, D., Cheung, C. M. K., Conboy, K., Doyle, R., Dubey, R., Dutot, V., Felix, R., Goyal, D. P., Gustafsson, A., Hinsch, C., Jebabli, I., … Wamba, S. F. (2022). Metaverse beyond the hype: Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, *66*, 102542. https://doi.org/10.1016/j.ijinfomgt.2022.102542

Ebele, O. T. (2024). Strategies for Integrating Indigenous Knowledge in Primary Education and its Impacts on Sustainable Development and Inclusive Growth. *Journal of Gender and Millennium Development Studies*. https://doi.org/10.64420/jgmds.v1i2.159

Erkanlı, A., Batman, K. A., & Kaptanoğlu, C. (2024). Examination of primary school teachers' attitudes and views towards multicultural education. *Frontiers in Education*, *9*, 1360696. https://doi.org/10.3389/feduc.2024.1360696

Familoni, B. T., & Onyebuchi, N. C. (2024). AUGMENTED AND VIRTUAL REALITY IN U.S. EDUCATION: A REVIEW: ANALYZING THE IMPACT, EFFECTIVENESS,

AND FUTURE PROSPECTS OF AR/VR TOOLS IN ENHANCING LEARNING EXPERIENCES. *International Journal of Applied Research in Social Sciences*, *6*(4), 642–663. https://doi.org/10.51594/ijarss.v6i4.1043

Fitrianto, I., & Farisi, M. (2025). Integrating Local Wisdom into 21st Century Skills: A Contextual Framework for Culturally Relevant Pedagogy in Rural Classrooms. *International Journal of Post Axial Futuristic Learning and Teaching*, *3*(2), 109–121.

Haddaway, N. R., Page, M. J., Pritchard, C. C., & McGuinness, L. A. (2022). PRISMA2020: An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and Open Synthesis. *Campbell Systematic Reviews*, *18*(2), e1230. https://doi.org/10.1002/cl2.1230

Hasan, Moh. F., Monita, D., Ar Rozi, H. A., & Sholihah, M. (2025). Reinvigorating the local wisdom of Soya-soya dance: Incorporating cultural values into primary school operational curriculum innovation in South Halmahera, Indonesia. *Research in Dance Education*, 1–20. https://doi.org/10.1080/14647893.2025.2570124

Huang, S.-Y., Tarng, W., & Ou, K.-L. (2023). Effectiveness of AR Board Game on Computational Thinking and Programming Skills for Elementary School Students. *Systems*, *11*(1), 25. https://doi.org/10.3390/systems11010025

Isnaniah, I., Marlina, M., & Ningsih, R. P. (2025). The Effectiveness of an Interactive Augmented Reality E-Book Featuring Local Wisdom of Kalimantan Selatan on English Learning Outcomes. *Salud, Ciencia y Tecnología*, *5*, 2214. https://doi.org/10.56294/saludcyt20252214

Jiang, H., Zhu, D., Chugh, R., Turnbull, D., & Jin, W. (2025). Virtual reality and augmented reality-supported K-12 STEM learning: Trends, advantages and challenges. *Education and Information Technologies*, *30*(9), 12827–12863. https://doi.org/10.1007/s10639-024-13210-z

Kleftodimos, A., Evagelou, A., Triantafyllidou, A., Grigoriou, M., & Lappas, G. (2023). Location-Based Augmented Reality for Cultural Heritage Communication and Education: The Doltso District Application. *Sensors*, *23*(10), 4963. https://doi.org/10.3390/s23104963

Kontogiorgakis, E., Zidianakis, E., Kontaki, E., Partarakis, N., Manoli, C., Ntoa, S., & Stephanidis, C. (2024). Gamified VR Storytelling for Cultural Tourism Using 3D Reconstructions, Virtual Humans, and 360° Videos. *Technologies*, *12*(6), 73. https://doi.org/10.3390/technologies12060073

Koumpouros, Y. (2024). Revealing the true potential and prospects of augmented reality in education. *Smart Learning Environments*, *11*(1), 2. https://doi.org/10.1186/s40561-023-00288-0

Lestari, T. D., & Sa'adah, N. (2021). Pendidikan Multikultural Solusi Atas Konflik Sosial: Indikasi Intoleran dalam Keberagaman. *JSPH (Jurnal Sosiologi Pendidikan Humanis)*, *6*(2), 140–154. https://doi.org/10.17977/um021v6i2p140-154

Lim, K.-S., & Lee, S. G. (2025). Integrating augmented reality (AR) and virtual reality (VR) for intercultural understanding: Exploring cultures and art through emerging technologies. *International Journal of Education Through Art*. https://doi.org/10.1386/eta_00197_1

Mahartini, K. T., Suastra, I. W., Sudiana, I. N., Gading, I. K., & Sanjaya, D. B. (2024). Crafting cultural narratives: Developing storybooks enriched with Bali's local heritage to improve students' understanding of spiritual and social attitude. *Edelweiss Applied Science and Technology*, *8*(6), 9322–9327. https://doi.org/10.55214/25768484.v8i6.3995

Martín-Gutiérrez, J., Mora, C. E., Añorbe-Díaz, B., & González-Marrero, A. (2017). Virtual Technologies Trends in Education. *EURASIA Journal of Mathematics, Science and Technology Education*, *13*(2). https://doi.org/10.12973/eurasia.2017.00626a

Mason, L., Tarchi, C., Ronconi, A., Manzione, L., Latini, N., & Bråten, I. (2022). Do medium and Context Matter when learning from multiple complementary Digital texts and videos? *Instructional Science*, *50*(5), 653–679. https://doi.org/10.1007/s11251-022-09591-8

Masood, T., & Egger, J. (2019). Augmented reality in support of Industry 4.0—Implementation challenges and success factors. *Robotics and Computer-Integrated Manufacturing*, *58*, 181–195. https://doi.org/10.1016/j.rcim.2019.02.003

Mota, J. M., Ruiz-Rube, I., Dodero, J. M., & Arnedillo-Sánchez, I. (2018). Augmented reality mobile app development for all. *Computers & Electrical Engineering*, *65*, 250–260. https://doi.org/10.1016/j.compeleceng.2017.08.025

Muhammad, A. E., & Liu, Y. (2025). Enhancing inclusivity in primary schools: The role of constructivist teacher education in addressing cultural diversity. *Education 3-13*, 1–20. https://doi.org/10.1080/03004279.2025.2475969

Mystakidis, S. (2022). Metaverse. *Encyclopedia*, *2*(1), 486–497. https://doi.org/10.3390/encyclopedia2010031

Nurhadianto. (2024). THE LEARNING IMPLEMENTATION OF CIVIC EDUCATION BASED ON LOCAL WISDOM IN GROWING SOCIAL AWARENESS FOR HIGH SCHOOL STUDENTS. *International Conference on Aplied Social Sciences in Education*, *1*(1), 677–682. https://doi.org/10.31316/icasse.v1i1.6880

Nurhayati, L., Supriadi, U., Jenuri, J., & Karim, A. (2025). Integrating digital citizenship and religious moderation in open and distance education: A holistic approach to character development in Indonesia. *Asian Association of Open Universities Journal*, *20*(3), 261–276. https://doi.org/10.1108/AAOUJ-02-2025-0025

Patras, Y. E., Japar, M., Rahmawati, Y., & Hidayat, R. (2025). Integration of Culturally Responsive Teaching Approach, Local Wisdom, and Gamification in Pancasila Education to Develop Students' Multicultural Competence. *Educational Process International Journal*, *14*(1). https://doi.org/10.22521/edupij.2025.14.45

Pellas, N., Fotaris, P., Kazanidis, I., & Wells, D. (2019). Augmenting the learning experience in primary and secondary school education: A systematic review of recent trends in augmented reality game-based learning. *Virtual Reality*, *23*(4), 329–346. https://doi.org/10.1007/s10055-018-0347-2

Pratiwi, V., Andayani, A., Winarni, R., & Anindyarini, A. (2022). Digital Storybook to Transform Character Education of Local Wisdom Figures for Elementary School Students. *Journal of Social Studies Education Research*, *13*(4), 250–264.

Prayogi, D. S., Utaya, S., & Sumarmi, S. (2019). Internalisasi Kearifan Lokal Dalam Pembelajaran melalui Pengembangan Multimedia Interaktif Muatan Pembelajaran IPS. *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan*, *4*(11), 1457. https://doi.org/10.17977/jptpp.v4i11.12990

Rachmadtullah, R., Syofyan, H., & Rasmitadila, Dr. (2020). The Role of Civic Education Teachers in Implementing Multicultural Education in Elementary School Students. *Universal Journal of Educational Research*, *8*(2), 540–546. https://doi.org/10.13189/ujer.2020.080225

Rakhimzhanova, L., Issabayeva, D., Kultan, J., Baimuldina, N., Issabayeva, Z., & Aituganova, Z. (2025). Using Augmented Reality to Teach Digital Literacy Course to Primary School Children with Special Educational Needs. *European Journal of Educational Research*, *14*(1), 55–71. https://doi.org/10.12973/eu-jer.14.1.55

Rambe, J. A., Erika, E., & Purba, N. A. (2022). Pengaruh Penggunaan Media Scrapbook terhadap Motivasi Belajar Peserta Didik pada Mata Pelajaran PKn Sekolah Dasar Islam Terpadu. *Jurnal Basicedu*, *6*(5), 7822–7830. https://doi.org/10.31004/basicedu.v6i5.3615

Rauschnabel, P. A., Felix, R., Hinsch, C., Shahab, H., & Alt, F. (2022). What is XR? Towards a Framework for Augmented and Virtual Reality. *Computers in Human Behavior*, *133*, 107289. https://doi.org/10.1016/j.chb.2022.107289

Riley, T., Meston, T., Cutler, C., Low-Choy, S., McCormack, B. A., Kim, E.-J. A., Nakar, S., & Vasco, D. (2024). Weaving stories of strength: Ethically integrating Indigenous content in Teacher education and professional development programmes. *Teaching and Teacher Education*, *142*, 104513. https://doi.org/10.1016/j.tate.2024.104513

Rochmiyati, S., Tiasari, L., & Ermawati. (2024). Promoting Character Education Through Genre-Based Language Learning: A Digital Reading Box in the Spotlight. *Theory and Practice in Language Studies*, *14*(3), 813–820. https://doi.org/10.17507/tpls.1403.23

Saavedra, M. O. R., Benavides, L. G. B., Cuentas Galindo, I., Campos Ascuña, L. M., Morales Gonzales, A. V., Mamani López, J. W., & Arguedas Catasi, R. W. (2025). *Augmented Reality As An Educational Tool: Transforming Teaching In The Digital Age*. Arts and Humanities. https://doi.org/10.20944/preprints202503.1049.v1

Sakti, S. A., Endraswara, S., & Rohman, A. (2024). Revitalizing local wisdom within character education through ethnopedagogy apporach: A case study on a preschool in Yogyakarta. *Heliyon*, *10*(10), e31370. https://doi.org/10.1016/j.heliyon.2024.e31370

Sari, A. T. R. & Wahyudi. (2023). Representation of the panji figure as a millennial-era avenger. *JURNAL PENDIDIKAN DASAR NUSANTARA*, *9*(1), 158–167. https://doi.org/10.29407/jpdn.v9i1.20810

Septinaningrum, Hakam, K. A., Setiawan, W., & Agustin, M. (2022). Developing of Augmented Reality Media Containing Grebeg Pancasila for Character Learning in Elementary School. *Ingénierie Des Systèmes d Information*, *27*(2), 243–253. https://doi.org/10.18280/isi.270208

Shih, N.-J., Chen, H.-X., Chen, T.-Y., & Qiu, Y.-T. (2020). Digital Preservation and Reconstruction of Old Cultural Elements in Augmented Reality (AR). *Sustainability*, *12*(21), 9262. https://doi.org/10.3390/su12219262

Sijabat, A., Festiyed, F., Razak, A., Diliarosta, S., Lufri, L., & Leonie, N. (2025). Development of ULOS Learning Model with AR to Foster Cultural Appreciation. *Aptisi Transactions on Technopreneurship (ATT)*, *7*(1). https://doi.org/10.34306/att.v7i1.471

Situmeang, T. A., Sintania, L. S., Lase, M., & Yunita, S. (2023). Pendidikan Pancasila dan Kewarganegaraan sebagai Optimalisasi dalam Meningkatkan Sikap Toleransi Siswa. *Journal on Education*, *5*(4), 16622–16629. https://doi.org/10.31004/joe.v5i4.2833

Subandi, G., Eriyanti, R. W., Karmiyati, D., Nurfaisal, N., & Widodo, J. (2025). A response to the character crisis: Can a digital Islamic character education based on local wisdom be the solution? *Perspectives in Education*, *43*(3), 236–253. https://doi.org/10.38140/pie.v43i3.8595

Tohri, A., Syamsiar, H., Rasyad, A., & Hafiz, A. (2022). The Relevance of Integrated Local Wisdom-based Social Study Learning Method in the Digital Society Era. *Jurnal TEKNODIK*, *26*(2).

Tom Dieck, M. C., & Jung, T. (2018). A theoretical model of mobile augmented reality acceptance in urban heritage tourism. *Current Issues in Tourism*, *21*(2), 154–174. https://doi.org/10.1080/13683500.2015.1070801

UNESCO. (2017). *Manuskrip Kisah Panji*. https://www.unesco.org/en/memory-world/panji-tales-manuscripts

Wang, M., Callaghan, V., Bernhardt, J., White, K., & Peña-Rios, A. (2018). Augmented reality in education and training: Pedagogical approaches and illustrative case studies. *Journal of Ambient Intelligence and Humanized Computing*, *9*(5), 1391–1402. https://doi.org/10.1007/s12652-017-0547-8

Wang, X.-M., Hu, Q.-N., Hwang, G.-J., & Yu, X.-H. (2023). Learning with digital technology-facilitated empathy: An augmented reality approach to enhancing students' flow experience, motivation, and achievement in a biology program. *Interactive Learning Environments*, *31*(10), 6988–7004. https://doi.org/10.1080/10494820.2022.2057549

Yulia, N. M., & Suttrisno, S. (2024). Developing Local Wisdom-Based Augmented Reality Modules for Science and Social Studies Learning in Elementary Schools. *AL-ISHLAH: Jurnal Pendidikan*, *16*(4). https://doi.org/10.35445/alishlah.v16i4.5987

Zou, Y., Kuek, F., Feng, W., & Cheng, X. (2025). Digital learning in the 21st century: Trends, challenges, and innovations in technology integration. *Frontiers in Education*, *10*, 1562391. https://doi.org/10.3389/feduc.2025.1562391